THE ANNALS OF "VALAHIA" UNIVERSITY OF TARGOVISTE
2010

OBSERVATIONS ABOUT TREATMENTS WARNING AND SOME INSECTICIDES EFFICACY IN *DELIA BRASSICAE* BCHÉ. PEST CONTROL

Lect. Ph.D. Loredana Beatrice Neagu Frăsin
Valahia University of Târgovişte
E-mail: loredana_beatrice2003@yahoo.com

Abstract

In Dâmbovița county, the cabbage root fly Delia brassicae Bché. has two generations per year, and to achieve an adequate control, treatments warning is made following 2 + 2 schedule. For each generation, the warning bulletins were issued at first adult emergence, ie on March 15, 2009, and March 21, 2010 for the first generation, on June 30, 2009 and June 26, 2010 for the second generation. As concern the effective temperature sum, treatments were warned at an average value of 48.25^{0}C for the first generation and 956.20^{0}C for the second generation.
In both years of observations, treatments were applied for each generation, according to the following rule: first treatment at 6-10 days after the warning date, the second treatment at 10-12 days after the previous, always before larvae hatching.
The best efficacy, of over 90%, in cabbage root fly control had the insecticides based on pirimiphos-methyl, diazinon, trichlorphon, deltamethrin, esfenvalerate and cypermethrin.

Keywords: warning, biological criterion, ecological criterion

1. INTRODUCTION

The cabbage fly – *Delia brassicae* is a pest of cultivated and spontaneous cruciferous plants, which produce important damages in cabbage, cauliflower, cole rape and radish crops [2]. Also, large losses were noticed in mustard [3], broccoli, kale and brussels sprouts crops, and occasionally in beets and celery crops [4].
The insect is spread in Europe and North America, mostly in U.S.A. and Canada. In our country it can be found in vegetable growing areas [1].
In addition to losses due to pest attack, which can reach up to 60% [2], [3] in the galleries formed by larvae in the root can grow different bacteria and saprophytic fungi [3] thus representing a penetration way of pathogens. An example is the *Plasmodiophora brassicae* fungus which produces roots hernia [4].

2. MATERIAL AND METHODS

Observations were made at the Phytosanitary Unit of Dâmbovița county - the Forecasting and Warning Station of Târgovişte, in the years 2009 and 2010.
Biological material was collected from field crops of autumn cabbage at the end of September. 1200 pupae were collected, and were placed in warning cages, buried in the ground so that they remain in the field under natural conditions.
In spring, from March 10, observations were made to establish the date of first adults emergence and their flight curve. For the summer generation, the biological material was collected from untreated cabbage crops which were attacked by larvae of this pest.
Treatments warning was made taking into account biological and ecological criteria.
Biological criterion is to determine optimal timing for control depending on the date of occurrence of the first adults or occurrence curve.
Ecological criterion involves determining the effective temperature sum that characterizes the date of adult stage occurrence.
We considered the generation whose pupae over-winter as first generation, and the summer generation as the second one.
Other authors [4] identify adults emergence placing yellow buckets filled with a solution consisting of water and soap, along the sidelines of the field, at 30 m intervals.
Insects fall into the water, being attracted by the yellow color. Buckets are emptied and filled again 4-6 days after. Thus, the population dynamics is observed. The maximum of the flight curve can be estimated by calculating the effective temperature sum, since the day when soil begins to thaw.
The efficacy of tested products was calculated using Abbot's formula:

$$E\% = \left[1 - a_2 / \left(N - M_2\right)\right] \times 100$$

where:

- E = product efficacy;
- a_2 = number of attacked plants for the untreated witness,

N = total number of analized plants,
M_2 = number of unattacked plants at the witness.

3. RESULTS AND DISCUSSIONS

The main pests which have limited cabbage production in Dâmbovița county in the years of observation are presented in Tables 1 and 2.

Table 1. Situation of pests that attacked cabbage crops in Dâmbovița county in the year 2009

Pest	Crop	Total area (ha)					
		Existent	Without attack	With attack	Weak	Moderate	Strong
Mamestra brassicae	cabbage	308	131	177	61	61	55
Phyllotretra spp.		308	186	122	67	55	-
Delia brassicae		308	236	72	72	-	-

Thus, it is noted that in 2009, *Delia brassicae* had an attack characterized as weak, on 72 ha of the 308 ha planted with cabbage.
In 2010, however, it was the second important pest considering its damages. The attack was observed on 280 ha of the 468 ha planted with cabbage, of which 110 ha with moderate attack and 60 ha with strong attack.
The limitation of injuries produced by the cabbage fly is related to the establishment of the moment for treatment applications.
As shown in Tables 3 and 4, in the climatic conditions of Dâmbovița county, *Delia brassicae* has two generations per year and over-winters in pupal stage.
A proper treatments warning requires knowledge of first adults emergence.
Thus, in the year 2009 (Table 3), the warning bulletin was issued on March 21.

Table 2. Situation of pests that attacked cabbage crops in Dâmbovița county in the year 2010

Pest	Crop	Total area (ha)					
		Existent	Without attack	With attack	Weak	Moderate	Strong
Mamestra brassicae	cabbage	468	98	377	196	114	60
Pieris bassicae		468	318	150	150	-	-
Phyllotretra spp.		468	297	171	106	65	-
Delia brassicae		468	156	312	142	110	60
Brevecoryne brassicae		468	256	212	118	74	20
Eurydema ornata		468	256	212	127	85	-

First treatment, to control the insects of first generation, was recommended to be applied within the period March 26 - 30 and the second treatment, within the period April 05 - 09, ie 10 - 12 days after the previous one.
For the second generation, the warning bulletin was issued when first adults emerged, i.e. on June 30, and treatments were recommended to be applied within the periods July 05-09 and July 15 – 18.
For a succesful control of both generations, treatments must be applied before larvae hatching. The effective temperature sum for treatments warning was 53.4^0C for the first generation and 968.6^0C, for the second generation. The treatment schedule is 2 + 2.

Table 3. Biological stages of *Delia brassicae* pest in the year 2009

Generation	Biological stage	Date	Tn - 6 (^{0}C)
I	pupa	- - 18.04	- - 127.8
	adult	21.03 - 10.05	53.4 - 299.9
II	egg	03.04 - 12.05	94.5 - 309.1
	larva	14.04 - 02.07	161.5 - 1,001.5
	pupa	15.05 - 15.07	324.6 - 1,276.2
	adult	30.06 - 12.08	968.6 - 1,862.1
I	egg	09.07 - 15.08	1,137.5 - 1,906.6
	larva	19.07 - 09.09	1,372.5 - 2,293.8
	pupa	08.08 - spring	1,785.0 - -

In the year 2010 (Table 4), warning has followed the same rule and started with the observation of first adults in breeding cages. Thus, warning bulletins were issued on March 15, when the effective temperature sum was 43.1^{0}C. Treatments against the first generation were applied as follows: first treatment, 6 - 10 days after the warning date, ie the period March 20 - 24, the second treatment, 10 - 12 days after, depending on insecticide persistence (from March 30 to April 03).

To control the second generation, warning was done on June 26, the first treatment between June 01-05.06, and the second one, between July 11 - 15. The effective temperature sum required for the adults emergence of this generation was 943.8 ^{0}C.

Table 5 shows that of the 16 insecticides tested, a very good average efficiency, of over 90%, had the products pirimiphos-methyl (Actel 50 EC), diazinon (60 Diazol EC), trichlorphon (Onefon 90 PS), deltamethrin (Decis 2.5 EC), esfenvalerate (Sumi-Alpha 2.5 EC) and cypermethrin (Fastac 10 EC, Cipertrin 10 EC, Polytrin 20 EC, Cyperguard 25 EC, Cymbush 10 EC).

Table 4. Biological stages of Delia brassicae pest in the year 2010

Generation	**Biological stage**	**Date**	**Tn - 6 (^{0}C)**
I	pupa	- - 15.04	- - 109.8
	adult	15.03 - 17.05	43.1 - 395.8
II	egg	25.03 - 01.06	86.3 - 589.2
	larva	01.04 - 27.06	120.8 - 959.0
	pupa	05.05 - 02.07	269.9 - 1,045.0
	adult	26.06 - 10.08	943.8 1,680.0
I	egg	06.07 - 13.08	1,173.0 1,750.4
	larva	19.07 - 05.09	1,363.4 2,051.4
	pupa	05.08 - spring	1,578.6 -

The rest of the insecticides tested had a good average efficiency, between 80% and 90%, except Aflix product which had a 74.5% average efficiency.

Table 5. Some insecticides efficacy in cabbage root fly control in the years 2009 and 2010

Crt. no.	**Active ingredient**	**Comercial product**	**Concentration (%)**	**Average efficacy (%)**
1.	pirimiphos-methyl	Actelic 50 EC	0.15	92.3
2.	diazinon	Diazol 60 EC	0.15	91.6
3.	triclorfon	Onefon 90 PS	0.15	95.7
4.	deltamethrin	Decis 2,5 EC	0.05	94.3

5.	esfenvalerate	Sumi-Alpha 2,5 EC	0.05	94.0
6.	cypermetrin	Fastac 10 EC	0.20	97.3
7.	cypermetrin	Cipertrin 10 CE	0.20	96.2
8.	cypermetrin	Polytrin 20 EC	0.015	93.7
9.	cypermetrin	Cyperguard 25 EC	0.015	94.3
10.	DDVP	Nogos 50 EC	0.10	82.3
11.	fosalon	Zolone 35 PM	0.15	86.3
12.	cypermetrin	Cymbush 10 EC	0.125	96.0
13.	lambda cyhalothrin	Karate 2,5 EC	0.01	83.4
14.	fenvalerate + fenitrotion	Sumicombi 30 CE	0.02	88.6
15.	edosulfan + dimetoate	Aflix	0.15	74.5

As concern the effective temperature sum, treatments warning was effected at an average value of 48.25^0C for the first generation and 956.20^0C for the second generation.
In both years of observations, treatments were applied for each generation, according to the following rule: first treatment – 6 - 10 days after the warning date, the second treatment – 10 - 12 days after the previous, always before larvae hatching.

4. CONCLUSIONS

Cabbage root fly – *Delia brassicae* is a dangerous pest of cabbage, causing damages by both attacking and creating conditions for some pathogen development.
In the climatic conditions of Dâmbovița county, the cabbage root fly - *Delia brassicae* has two generations per year, and for a proper control, the treatment schedule is 2 + 2.
For each generation, the warning bulletins were issued at first adults emergence, ie on March 15, 2009, and March 21, 2010 for the first generation, on June 30, 2009 and June 26, 2010 for the second generation.

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